REMARKS

Overview of the Office Action

Claim 1 has been rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's admitted prior art Figs. 1 and 2 ("APA") in view of U.S. Patent No. 6,343,026 to Perry ("Perry").

Claims 1-7 have been rejected on the ground of non-statutory obviousness-type double patenting as being unpatentable over claims 1-7 of U.S. Patent No. 6,909,249 in view of APA.

Status of the claims

Claims 1 and 2 have been amended.

Claim 8 has been newly added.

Claims 1-8 are now pending.

Summary of subject matter disclosed in the specification

The following descriptive details are based on the specification. They are provided only for the convenience of the Examiner as part of the discussion presented herein, and are not intended to argue limitations which are unclaimed.

Applicant's invention provides a switching constant-current power supply device that is suitable for supplying a stabilized current to a load that is subjected to an intermittent load current that occurs repetitively at frequencies of approximately several hundred Hertz. The switching constant-current power supply of the present invention generates a second feedback signal equivalent to a first feedback signal when the level of the first feedback signal drops to substantially zero due to intermittence of the load current in order to prevent an output of a first power converter circuit from becoming too high, and provides the generated second feedback

signal to a control circuit. The first feedback signal is a signal that is generated by a current detector circuit so that the first feedback signal has a level proportional to the load current. The second feedback signal is a signal that is generated by a signal holding section so that the second feedback signal has a level almost equal to the first feedback signal. A particular function of this configuration is to maintain the operation state of the first power converter circuit as if the load current was continuously flowing when the load current has actually being interrupted.

Descriptive summary of Applicant's admitted prior art (APA)

In contrast to Applicant's invention, the APA discloses power supply circuits that apply the operation principle of a Royer oscillation circuit (Fig. 1) as a means for obtaining an AC or pulsed current. In order to stabilize a current supplied from a Royer-type power supply circuit to a load, a converter circuit for controlling a DC output voltage has been coupled to the input side of the Royer-type power supply circuit. This converter circuit is operable to control a voltage supplied to the Royer-type power supply circuit to indirectly control an AC or pulsed current supplied from the Royer-type power supply circuit to a load.

Descriptive summary of Perry

Perry discloses a current limit circuit for a power supply that includes first and second interleaved power converters. The current limit circuit includes a peak detection circuit connected to a current sensing circuit of the power supply, a sample/hold circuit connected to the peak detection circuit, and an averaging filter circuit connected to the sample/hold circuit. A current sensing signal (generated by the current sensing circuit) is supplied to the current limit

circuit, and a signal generated by the current limit circuit is supplied to a first input terminal of a PWM control circuit.

Claim 1 is allowable over the APA in view of Perry under 35 U.S.C. 103(a)

The Office Action states that the combination of the Applicant's admitted prior art (APA) and Perry teaches all of Applicant's recited elements. Reconsideration and withdrawal of the rejection are respectfully requested in light of the following remarks.

Independent claim 1 has been amended to point out more clearly what Applicant regards as the invention. Specifically, independent claim 1 has been amended to recite a switching constant-current power supply system that includes a switching-type first power converter circuit operable in response to supply of power from an external power source to generate a stable DC voltage and a second power converter circuit capable of functioning as a DC-AC converter and operable in response to supply of said DC voltage to supply an AC or pulsed current to a load. The switching constant-current power supply system further includes a current detector circuit for generating a first feedback signal in proportion to a load current, and a control circuit for controlling the operation of the first power converter circuit according to the first feedback signal so as to stabilize the load current. The switching constant-current power supply system further includes a feedback circuit provided between the current detector circuit and the control circuit. The feedback circuit includes a signal hold section for holding a signal and is operable to supply the first feedback signal to the control circuit when the load current flows and to supply a second feedback signal to the control circuit when the load current does not flow, wherein the second feedback signal has a signal value approximately equal to that of the first feedback signal at a

certain time point. Support for the claim amendment can be found at least in paragraph 0044 of the published application, and in the original claim 2.

Neither the APA nor Perry teaches or suggests a control circuit for controlling the operation of the first power converter circuit according to the feedback signal so as to stabilize the load current, or a feedback circuit that includes a signal hold section for holding a signal and is operable to supply a first feedback signal to the control circuit when the load current flows and to supply a second feedback signal to the control circuit when the load current does not flow.

In other words, Applicant's invention recites that the first feedback signal and the second feedback signal are supplied to the control circuit on a complementary and selective basis depending upon the presence or absence of the load current. In contrast to Applicant's invention, both of the current sensing signal and the signal generated by the current limit circuit of Perry are supplied to the PWM control circuit depending upon the presence or absence of an over-current state, and not the presence or absence of the load current.

The level of the second feedback signal according to Applicant's invention is almost the same as the level of the first feedback signal taken at certain time point because the former level is set intentionally. Specifically, the level of the second feedback signal is set, for example, at the peak value of the first feedback signal.

In contrast, Perry teaches that the signal generated by the current limit circuit is set at the average value of the pulsed current sensing signal. Because the signal generated by the current limit circuit is set at the average value of the current sensing signal, it is never set to a value at acertain time point, such as at the peak value, of the current sensing signal.

The first feedback signal as recited in Applicant's invention is supplied to the control circuit while the load current flows, and functions to supply a signal that stabilizes the load

current (i.e. a pulse signal in accordance with the first feedback signal) from the control circuit to the first power converter circuit.

In contrast, the current sensing signal taught by Perry is supplied to the PWM control circuit while a current flows into the converter, and functions to stop the supply of a PWM signal from the PWM control circuit to the converter when the load current is put in an over-current state. On the other hand, the current sensing signal does not provide any function to the operation of the PWM control circuit when the load current is not put in an over-current state. This operation is further described in an IC catalogue of UCC3800 series circuitry that is mentioned in Perry.

The current sensing signal taught by Perry is a signal for realizing a system for short circuit protection. In contrast, the first feedback signal recited in Applicant's invention is a signal for realizing a system for feedback control known as constant current control.

As made clear from the above, the current sensing signal of Perry and the first feedback signal recited in Applicant's invention differ from each other in their purpose and function. This difference results from whether a signal is supplied to an input terminal for feedback control, as with Applicant's invention, or an input terminal for short circuit protection, as taught by Perry.

It should be noted that the input terminal for feedback control according to the circuit of Perry is a first input terminal to which the output of a voltage control amplifier 28 is supplied. Therefore, the current sensing signal S according to Perry is not a feedback signal "for controlling the operation of the first power converter circuit" which is used "in order to stabilize the load current."

The L signal generated by the current limit circuit taught by Perry is supplied to the PWM control circuit while the load current is put in an over-current state, and functions to

supply a PWM signal from the PWM control circuit to the converter to prevent the load current from increasing. It should be noted that the over-current state can occur when the load current flows but it does not occur when the load current does not flow except for the occurrence of a short circuit failure inside the converter. The signal L generated by the current limit circuit taught by Perry is not supplied while the load current is interrupted.

In contrast, the second feedback signal recited in Applicant's invention is supplied to the PWM control circuit while the load current is interrupted, and functions to supply a signal that maintains the state of the first power converter circuit from the PWM control circuit to the converter.

The period during which the signal generated by the current limit circuit taught by Perry is supplied differs from the period during which the second feedback signal of Applicant's invention is supplied. The period taught by Perry is a period during which the load current flows, while the period of Applicant's invention is a period during which the load current is interrupted. With this difference in the signal supply period, the L signal generated by the current limit circuit taught by Perry is a signal for realizing a system for overload protection. In contrast, the second feedback signal recited in Applicant's invention is a signal for realizing a new control system, which has a preparatory state in anticipation of the restart of load operation.

Moreover, since the L signal generated by the current limit circuit taught by Perry is a signal for realizing an overload protection system, it is required to have a value proportional to the average value or the effective value of the load current. Consequently, the L signal generated by Perry's current limit circuit is set at the average value of the pulsed current sensing signal S. Because the L signal generated by the current limit circuit is set at the average value of the

current sensing signal S, it is never set at the same level as the value of the current sensing signal S at a certain time point, such as the peak value.

In contrast, the second feedback signal recited in Applicant's invention is set at almost the same level as the first feedback signal at a certain time point to create the fictitious circuit condition in which the load current flows. The second feedback signal is preferably set at the peak value of the first feedback signal. In other words, the second feedback signal recited in Applicant's invention, which is set intentionally at almost the same level as the first feedback signal at a certain time point, differs in its purpose and function from the signal generated by the current limit circuit of Perry, which does not have a signal level equal to the current sensing signal level. Therefore, the signal L generated by the current limit circuit of Perry does not correspond to a feedback signal that is supplied to the control circuit when the load current does not flow and has a level almost equal to the first feedback signal supplied when the load current flows, as recited in Applicant's invention.

As described above, it is evident that the first feedback signal and the second feedback signal recited in Applicant's invention differ completely from the current sensing signal S and the signal L generated by the current limit circuit signal Perry. The differences between the former signals and the latter signals are attributable to the fact that Perry discloses the following configuration:

(i) The current sensing signal is supplied to the terminal for a short circuit protection system, not a terminal for feedback control.

(ii) The terminal for feedback control receives the signal L from the current limit circuit only, which is not either one of two signals that are supplied selectively depending upon the presence or absence of the load current.

(iii) The L signal generated by the current limit circuit is supplied to the control circuit at the time of an over-current state, not at the time of interruption of the load current.

(iv) The level of the L signal generated by the current limit circuit is set at the average value of the current sensing signal S and not, for example, at the peak value thereof.

From the above, it cs readily apparent that the circuit taught by Perry and the feedback circuit recited in Applicant's invention differ from each other fundamentally in their internal configuration and signal generation functions.

In view of the foregoing, it is respectfully submitted that the APA and Perry, whether taken alone or in combination, do not teach or suggest the subject matter recited in Applicant's amended independent claim 1. Accordingly, claim 1 is patentable thereover under 35 USC 103.

Dependent claims

Claims 2-7, which depend directly or indirectly from independent claim 1, incorporate all of the limitations of independent claim 1 and are, therefore, deemed to be patentably distinct over the APA and Perry for at least those reasons discussed above with respect to independent claim 1.

New claim 8 recites that "the first feedback signal and the second feedback signal are supplied to the same single terminal of the control circuit on a complementary basis." In contrast, Perry teaches that the current sensing signal and the signal generated by the current limit circuit are supplied to different input terminals of the PWM control circuit on an

independent basis. Thus, claim 8 even more clearly distinguishes the present invention 9over the prior art.

Double Patenting Rejection

Claims 1-7 have been rejected on the ground of non-statutory obviousness-type double patenting as being unpatentable over claims 1-7 of U.S. Patent No. 6,909,249 in view of APA.

In order to overcome the obviousness-type double patenting rejection, Applicant hereby submits a Terminal Disclaimer, which is attached hereto.

Applicant submits that the double patenting rejection is now overcome.

Conclusion

In view of the foregoing, reconsideration and withdrawal of all rejections, and allowance of all pending claims is respectfully solicited.

Should the Examiner have any comments, questions, suggestions, or objections, the Examiner is respectfully requested to telephone the undersigned in order to facilitate reaching a resolution of any outstanding issues.

Respectfully submitted,
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Dated: December 12, 2006